

# Impact of Continuous Glucose Monitoring on Glycemic Control in Patients with Type 2 Diabetes

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## Abstract

- Management of type 2 diabetes mellitus (T2DM) is focused on strict glycemic control in order to prevent complications.
- Currently, self-monitoring of blood glucose (SMBG) with fingerstick blood sample is the conventional method to assess short-term glycemic control.
- Due to several limitations of SMBG, continuous glucose monitoring (CGM) is emerging as a potential replacement for SMBG in patients with type 2 diabetes.
- Therefore, this study examines whether CGM leads to greater improvement in glycemic control compared to SMBG in nonpregnant adults with T2DM.

## Introduction

- In the U.S., 34.1 million adults (age  $\geq 18$  years) or 13% of the adult population are diagnosed with T2DM.<sup>1</sup>
- Prevalence of T2DM is the lowest in non-Hispanic whites, higher in Asians and Hispanics, and the highest in African Americans.<sup>1</sup>
- Effective glycemic control is integral to diabetes management in order to lower the risk of complications such as retinopathy, neuropathy, cardiovascular disease and renal disease.<sup>2,3</sup>
- SMBG with fingerstick blood sample has traditionally been used to monitor short-term glycemic control. However, several barriers limit its use, such as discomfort, inconvenience, and high costs.<sup>3-6</sup>
- CGM technology uses subcutaneously inserted sensors to measure real-time interstitial glucose levels throughout the day, providing convenience, ease of use and data shareability at lower costs.<sup>7-9</sup>
- Currently, CGM is the gold standard of care for adults with type 1 diabetes (T1DM) and used less frequently in those with T2DM.<sup>3</sup>
- Several studies have shown mixed results regarding whether CGM improves glycemic control in patients with T2DM.<sup>10, 11</sup>
- Therefore, more research is needed to determine the effectiveness and optimal uses of CGM in patients with T2DM.

## Methods

- A literature search was performed in November 2019 using PubMed, Academic Search Ultimate, and Google Scholar.
- Search terms used were "type 2 diabetes OR type 2 diabetes mellitus AND continuous glucose monitoring OR CGM".
- Inclusion and exclusion criteria were manually applied for study selection. Any duplicate studies were removed.
- Randomized control trials, cohort studies, or case-control studies with sample size  $>100$ , published in 2014 or later were considered.
- This left a final set of 7 articles for critical appraisal.

## Results

All 7 studies differed in the glycemic parameter affected by CGM use, as shown in Table 1. However, at least 1 variable was shown to be significantly associated with the CGM use in each of the studies. Notably, the study by Anjana et al. showed that a single CGM wear lasting 14 days was enough to produce a clinically meaningful change in HbA1c at 3 months. Also, the greatest improvement in glycemic control was seen in participants using multiple dose insulin (MDI) injections and in those with baseline hyperglycemia of  $>240$  mg/dL, according to the studies by Ajjan et al. and Ruedy et al. However, New et al. found that the CGM group with continuous subcutaneous insulin infusion (CSII) had a significantly improved glycemic control, while those with MDI did not. In the study by Ajjan et al., healthcare providers reported that CGM data aided their communication with patients and treatment adjustments. Also, multiple studies showed that advanced age did not appear to be a barrier to using CGM devices.

### Other findings associated with CGM use

- **HbA1c** (long-term glycemic control): significant improvement in 4/6 studies
- **Diabetes treatment satisfaction**: significant improvement in 4/4 studies
- **Diabetes quality of life**: significant improvement in 2/3 studies

Table 1. Comparison of Results

Study	Hypoglycemia		Euglycemia	Hyperglycemia	
	$<55$ mg/dL	$<70$ mg/dL	70-180 mg/dL	$>180$ mg/dL	$>240$ mg/dL
Ajjan et al (2019)	N/A	NS	NS <sup>a</sup>	NS	NS
Anjana et al (2017)	N/A	N/A	N/A	N/A	N/A
Haak et al (2016)	S	S	NS	NS	NS
Jangam et al (2019)	S <sup>a</sup>	S <sup>a</sup>	N/A	S <sup>a</sup>	S <sup>a</sup>
New et al (2015)	N/A	S <sup>b</sup>	NS	N/A	N/A
Ruedy et al (2017)	N/A	N/A	S	N/A	S
Yaron et al (2019)	N/A	N/A	N/A	N/A	N/A

### Key

S = significant improvement compared to control ( $p \leq 0.05$ )

NS = not significant improvement compared to control ( $p > 0.05$ )

N/A = not available

a=Results were compared to baseline values instead of control values.

b=Result was significant in the intervention group that utilized CGM with alarms, while it was insignificant in the intervention group without alarms.

## Discussion

6/6 studies report that at least 1 glycemic parameter was significantly improved in CGM group compared to SMBG group.

### Strengths:

- ❖ Diverse clinical settings and countries
- ❖ Most (5/7) were randomized control trials
- ❖ Study duration of at least 2-3 months
- ❖ Sample size of at least 100 participants

### Weaknesses:

- ❖ Lack of demographic diversity in participant pool (most were non-Hispanic whites in their 60s)
- ❖ Lack of blinding
- ❖ Potential for sponsorship bias and observer bias

### SMBG



### CGM



Note: Images adapted from <https://www.hcd.com>

## Conclusion

- The findings of the 7 studies collectively suggest that CGM may be beneficial in improving glycemic control, particularly in patients with insulin-treated T2DM.
- CGM can potentially be a useful tool in guiding treatment decisions including insulin dose adjustments as well as in serving as a basis for patient education and counseling.
- Limited and variable evidence for benefits of CGM in T2DM warrants further focused research in this topic.
- Future studies should involve more accurately represented demographics in participant pool and independent, third-party researchers to reduce potential sponsorship bias.

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